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EP 00/08757

4

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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. Patent application No. Demande de brevet n°

99202880.3

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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THE HAGUE,
LA HAYE, LE 24/11/00

Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Demandeur(s):
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5581 GM Waalre
NETHERLANDS

Bezeichnung der Erfindung:
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Titre de l'invention:
Method for e-mail communication, apparatus therefor and use of said method and apparatus for electronic metering and for home automation

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

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METHOD FOR E-MAIL COMMUNICATION, APPARATUS THEREFOR AND USE OF SAID METHOD AND APPARATUS FOR ELECTRONIC METERING AND FOR HOME AUTOMATION

Field of the invention

The invention relates to a method for e-mail communication, apparatus therefor and use of said method and apparatus for electronic metering and for home automation.

In a first aspect the present invention relates to a method and apparatus which allows Internet-type-communication between users connected via publicly switched telephone networks wherein the Internet as a transport medium is not required.

The primary application thereof is electronic mail. However, the method and apparatus allow many other Internet-type applications. In particular two important applications have been addressed here:

- Electronic meter-reading (an application of importance for e.g. utility companies), and
- Home / building automation applications.

New is that the method and the apparatus allow e-mail transmission between two addresses connected to the traditional public switched telephone network. The new inventive applications based on this new e-messaging concept, are:

1. All e-mail based messaging modalities;
2. Remote meter-reading;
3. Remote switching of devices/appliances connected to a home/building "intranetwork" (As "intranetwork" in our invention serves the main power network).

The preferred embodiment of the invention in this application is referred to as TeleMail method and TeleMail device.

When no new e-mail messages have arrived, this effort has been in vain.

To avoid these difficulties in the prior art, it would be desirable to provide a method and apparatus which makes e-mail communication as easily applicable and intuitive to use as, for example, telephone and facsimile communication, and which does not require involvement of third parties (e.g. an Internet Service Provider), without ruling out the possibility of Internet communication in the conventional manner (i.e. via an Internet Service Provider).

The invention provides therefor a method according to claim 1.

Preferred embodiments of the method are given in claims 2 and 3. The invention is further related to a method according to claims 4 and 5. The apparatuses of the invention are given in claims 5 to 8.

Regarding the second aspect, currently, collection of metering information (e.g. by the electricity company) is either done by persons who visit the customer location in order to read the numbers on the meter, or the customers themselves report the numbers periodically. In the latter case, the numbers still need to be verified by officials of the utility company every once in a while. This has two major disadvantages:

collection of metering information is labor-intensive and therefore costly;

the metering information cannot be used for load monitoring and anticipation;

a need exists to provide a method and system which allows utility companies to remotely collect metering information from the customer premises which - depending on the sampling frequency - can also be used for operations management purposes.

In the third aspect an interesting application of the Telemail device can be developed, in connection with the main power network, which can function as a home automation network.

includes the possibility of an attachment of data files to the e-mail message.

As a sender, the appliance is capable of establishing TCP/IP communication with a similar and compatible receiving device over the PSTN (either through a modem or directly over an ISDN), according to the Point-to-Point Protocol (PPP). Where IP addresses are needed for PPP and TCP/IP communication, dummy addresses are derived from the communicating parties' telephone numbers which are stored in both the sender and receiver apparatus. In a similar manner wireless communication could be realized (e.g. by using GSM as network interface).

As a receiver, the appliance is able to respond to an incoming telephone call by going off-hook, and establishing TCP/IP communication with the sender apparatus. Once the data communication is established, the e-mail message can be transferred to the receiver device according to the Simple Mail Transfer Protocol (SMTP) or another Internet Suite Protocol. The apparatus will be in stand-by mode as long as it is switched on.

As a receiver, the apparatus is able to store incoming e-mail messages and activate a visual and/or audible indicator that new e-mail has arrived.

As a receiver the apparatus is able to visually present e-mail messages through a Graphical User Interface application. This includes presentation of data files which can be attached to the e-mail message.

The apparatus can be realized as a stand-alone unit which accomodates all the functions needed to fulfil the service of the present invention. Alternatively, the apparatus can be realized as a peripheral device to a computer. Such peripheral would accomodate only those functions which are needed to receive and store incoming e-mail messages.

Since the apparatus is conceived to communicate via TCP/IP channels, it can also be employed to make use of other Internet applications, such as World Wide Web

communication, and the message forwarding included in the TeleMail concept.

This may become quite advantageous e.g. in the following cases:

1. Each physical address, accessible via telephone connectivity can receive e-mail and thus replace traditional mail. This may lead to significant cost savings for businesses/organizations due to the 'short-circuiting' of the traditional mailing system.

2. Each physical address, accessible via telephone connectivity, can be contacted by utility companies for periodic meter-reading. As an instance this may be of advantage for electricity companies' load management system and program responsibility. Obviously this will lead to significant cost savings. This application may require special arrangements to safeguard privacy (see the second aspect of the present invention).

3. The Telemail device can be used as a central server of a home "intranetwork". Such TeleMail device can store a website. Consequently, each appliance at a physical address, connected to the home "intranetwork" is accessible via telephone connectivity, and can be operated via the public switched telephone network by interacting between its TeleMail website and a device connected elsewhere to the telephone network (e.g. palmtop or other TeleMail device). Obviously this will lead to a straightforward operation of appliances in a home (or building) and somebody operating from the outside.

Call-centers are increasingly being contacted also via e-mail. The TeleMail device also provides call-center communication. Also for the functioning of the call-center the TeleMail connectivity is advantageous, since confirmations of agreements can be forwarded on-line.

Businesses are able to improve direct marketing methods since they can combine within their ICT systems

Once the data communication between Box and Host (or vice versa) has been established, the Box application can exchange information with the Host application. To identify itself to the Host application, the Box is assigned a unique 32-bit identifier which is also used as (alias) IP address for protocol purposes.

Since the utility company can access the metering information without knowledge of the customer, it may be desirable or even required to send a notification to the customer that the information has been collected (either via electronic or postal mail).

The third aspect TeleControl functionality is an application based on the TeleMail platform according to claims 14-18. Two major functions can be distinguished within the TeleControl application:

1. centralized, user-definable control over accessible devices;

2. providing remote access to the above function.

The first function is realized by connecting a home automation control unit to one of the general-purpose interfaces of the TeleMail device. The control-unit can address other units through a power-line modem. These units in their turn can control devices such as light bulbs, switches, heating systems, domestic appliances, alarm systems, etc.. Alternatively, the control unit can be integrated in the TeleMail device enclosure.

The user can access the TeleControl functionality through a graphical user interface (GUI) which runs as a TeleMail application. The graphical user interface consists mainly of an HTML file, which can be presented with any compliant web browser application. Through the user interface, the user can invoke Common Gateway Interface (CGI) processes on the TeleMail device, which in their turn control a target device.

Remote access to the TeleControl (second function) functionality is provided by calling the

ITU-T I.series compliant Integrated Services Digital Network (ISDN).

Figure A.8 is a simplified OSI model representation of the TeleMail communication over an ITU-T V.series compliant modem (e.g. V.32, V.34, V.90) over the Public Switched Telephone Network.

Figure B.1 provides an overview of the MeterNet system, according to the present invention, including a number of MeterNet Boxes [M1], [M2] and [M3] at the customer premises, and a MeterNet Host [H1] at the premises of a Utility Company with connection to the Utility Company Server; all devices are connected and have access to the Public Switched Telephone Network [PSTN].

Figure B.2 is a functional block diagram of an embodiment of a MeterNet Box [M4], according to the present invention.

Figure B.3 is a functional block diagram of an embodiment of a MeterNet Host [H2], according to the present invention.

Figure B.4 is a flowchart description of the procedure to collect metering information from a single MeterNet Box.

Figure B.5 is a flowchart description of the procedure to report information by a single MeterNet Box to a MeterNet Host.

Figure B.6 is a simplified OSI model representation of the MeterNet communication over an ITU-T V.series compliant modem (e.g. V.32, V.34, V.90) over the Public Switched Telephone Network.

Figure B.7 is a simplified OSI model representation of the MeterNet communication through an ITU-T I.series compliant Integrated Services Digital Network (ISDN).

Figure C.1 provides an overview of the TeleControl system, according to the present invention, including a set of two TeleMail devices [TM1] and [TM2], a TeleControl System Control Unit [SCU], and a

Provider (ISP). This TeleMail device maintains a database with the telephone numbers of all addressees who make use of the e-mail forwarding service. The TeleMail device **103** opens a switched telephone connection **105** through the PSTN **104**. Once the connection is established, transfer of the electronic mail from the ISP to the receiver application commences.

A block diagram of a stand-alone embodiment of a TeleMail device, according to the present invention, is shown in Figure A.2. Apart from the data transmission and line interfacing, all functions are performed by a microprocessor **201**. The microprocessor is supported by memory **205**, which comprises both volatile and non-volatile memory. The microprocessor provides its output on a display **202**. The user provides input through a keyboard **203** and a pointing device **204**. When a touch-screen is used as display, both keyboard and pointing device can be incorporated in the touch-screen. The microprocessor **201** has some general purpose interfaces (e.g. serial and parallel ports, USB) at its disposal which can be used to add peripherals (e.g. a printer, a Web camera, a joystick) as enhancement to the TeleMail functionality.

The line interface circuitry **208** is able to detect an incoming call, upon which it alerts the microprocessor. Thus, the TeleMail device is able to act as a receiver.

A block diagram of a computer-peripheral embodiment of a TeleMail device, according to the present invention, is shown in Figure A.3. Apart from the data transmission **307** and line interfacing **308**, all functions are performed by a microprocessor **301**. The microprocessor is supported by memory **306**, which comprises both volatile and non-volatile memory. The microprocessor provides status information through perceptible (e.g. visual and/or audible) indicators **305**. The computer-peripheral TeleMail device is configured by a host Personal Computer (PC) **302** through one of the interfaces **303** or **304**. A

addressee makes use of the TeleMail message forwarding service. A database application on the host computer maintains a TeleMail database **410** of all e-mail addressees who make use of the TeleMail message forwarding service. The host computer retrieves the telephone number, and the line interface type (analog or ISDN) of the addressee TeleMail device from the TeleMail database. Along with the telephone number and line interface type information, the e-mail message is transferred to the ISP TeleMail device which transmits it to the TeleMail device of the e-mail addressee.

An architecture block diagram of the TeleMail software, according to the present invention, is shown in Figure A.5. The TeleMail software consists of a Graphical User Interface (GUI) **501**, application software **502**, an operating system **503**, and hardware drivers **504**. Although primarily intended for e-mail communication, other applications can be installed as enhancements, which may require that the TeleMail is equipped with additional periherals. For example, if a web camera is connected to the TeleMail devices at both ends (e.g. T1 and T2 in Figure A.1), it can be used for low-bandwidth video conferencing. Printing and scanning devices, addressed through the general purpose interfaces, can also provide added functionality.

A functional block diagram of the ISP TeleMail database software for forwarding of e-mail messages to a TeleMail device at the user premises, according to the present invention, is shown in Figure A.6. The software consists of two subsystems: a database application on the host computer, and an embedded TeleMail application on the processor of the ISP TeleMail device.

Messages which are forwarded by the ISP mail server to the ISP TeleMail host computer through interface **603**, are fed into a first-in first-out (FIFO) receive queue **601**, to avoid information loss in case of bursty message arrival. The size of this queue can be changed dynamically. The e-mail messages are read from

maintained by the Internet server (according to the PPP protocol).

A number of MeterNet Box (101, 102, 103) and a MeterNet Host device (105) of the present invention, and the system in which it operates is shown in Figure B.1. All devices have access to the Public Switched Telephone Network (PSTN) 104 through subscriber loops (108, 109, 110, and 111). The MeterNet Host device 105 also communicates with a server computer of the utility company (106). In order to establish communication between the MeterNet Box 102 and the MeterNet Host 105, either device can open a switched telephone connection 107 through the PSTN 104. Once the connection is established, transfer of the electronic data between the sender and receiver applications commences.

A block diagram of an embodiment of a MeterNet Box device, according to the present invention, is shown in Figure B.2. Apart from the data transmission 202 and line interfacing 203, all functions are performed by a microprocessor 201. The communication port 202/203 can be an analog modem interface or a digital ISDN interface. The microprocessor is supported by memory 204, which comprises both volatile and non-volatile memory. The microprocessor 201 has a meter interface 206 at its disposal which can be used to collect information from a compatible meter (not depicted). The line interface circuitry 203 is able to detect an incoming call, upon which it alerts the microprocessor 201. The MeterNet Box also comprises a storage unit 205 for a unique permanent 32-bit identifier, which also serves as alias IP address during TCP/IP communication.

A block diagram of an embodiment of a MeterNet Host device, according to the present invention, is shown in Figure B.3. Functionally, the MeterNet Host has two communication ports at its disposal: one for (analog) modem communication 302/303, one for (digital) ISDN communication 304/305. Depending on to which type of subscriber loop the MeterNet Box device is connected, the

parameters are then transferred to the MeterNet Host device for further processing (step 404). In the MeterNet Host the job is fed into a job queue, depending on the line type of the addressed MeterNet Box (step 405). For each line type, an independent job queue is provided.

From the job queue, the jobs are fetched by the next step in the procedure (step 408 and 409, for digital and analog line interfaces, respectively). In this step, the MeterNet Host opens a switched telephone connection to the addressed MeterNet Box, requests and receives the information from the addressed MeterNet Box, and terminates the connection. After succesful collection of the requested information, the information is transferred to the server (step 410). The server updates the database with the newly acquired information (step 411), and schedules the next request (step 412).

A flowchart description of the procedure to report metering information by a MeterNet Box to a MeterNet Host, according to the present invention, is shown in Figure B.5. Upon detection of an event which was marked as requiring a report to the MeterNet Host (event 501), the MeterNet Box opens a switched telephone connection to the MeterNet Host (step 502). The MeterNet Host detects the incoming call (step 503), and responds by going off-hook (step 504), after which the data link is initialized (step 505) in accordance with the Point-to-Point Protocol (PPP). After establishment of the data link, the data is transferred by the MeterNet Box to the MeterNet Host (step 506). After succesful reception, the MeterNet Host triggers the update of the database 510 with the newly acquired information (step 507). If no further information is needed the data link (step 508) and telephone connection (step 509) are terminated.

Depending on the type of subscriber loop (POTS or ISDN), the protocol stacks differ. Figure B.6 shows the protocol stack for POTS, Figure B.7 shows the protocol stack for ISDN. The only difference lies in the

broadcast a message onto the mains network **103**, destined for Appliance Control Unit **104**.

The message contains the unique identifier of Appliance Control Unit **104**, and the instruction that needs to be performed (e.g. "turn off"). Due to the nature of broadcasting all Appliance Control Units (**104**, **105**, **106**) will receive the message; only Appliance Control Unit **104** will handle the message, based upon recognition of its identifier.

The user can access the TeleControl application from a remote location by using another TeleMail device **111** to call the TeleMail device at the user premises **101**. Once the telephone connection **113** through the Public Switched Telephone Network **112** has been established, the user can load the GUI application into a web browser on TeleMail device **111**. Activating the controls in the GUI, has the same effect as accessing them locally (i.e. on TeleMail device **101**), as described above. Alternatively, also a PC can be utilized to communicate with the home TeleMail device.

A block diagram of an embodiment of a System Control Unit , according to the present invention, is shown in Figure C.2. Apart from the power-line modem functions **202** and mains interfacing **203**, all functions are performed by a microprocessor **201**. The microprocessor is supported by memory **204**, which comprises both volatile and non-volatile memory. The microprocessor **201** has a TeleMail interface **206** at its disposal which is used to receive command message and transmit report from/to the TeleMail device. The mains interface circuitry **203** connects to the mains network. The System Control Unit also comprises a storage unit **205** for a unique permanent network identifier. This identifier is used in combination with the identifiers of the connected Appliance Control Units to uniquely qualify the Appliance Control Units within a home automation network (see below).

CLAIMS

1. A method for establishing e-mail communication between two users who both have access to the Public Switched Telephone Network, without the need of being connected to the Internet, comprising the steps of:

A) establishing the data link, and PPP connection between the sender and receiver application; and

B) transferring the e-mail message(s) to the receiver device over TCP/IP.

2. A method according to claim 1, further comprising the steps of:

C) composing one or more electronic mail messages through a Graphical User Interface application;

D) setting up a telephone connection to receiver device;

E) acceptance of the call by the receiver device;

F) storage of the e-mail message(s) on the receiver device;

G) termination of the data link and telephone connection;

H) perceptible (e.g. visual and/or audible) indication that an e-mail message has been received by the receiver application;

I) visual presentation of the e-mail message (including attached files) by the receiver Graphical User Interface application.

3. A method according to claim 1 or 2, further comprising the step of:

J) retrieving the telephone number of the receiver from a database;

4. A method of deriving an alias IP address from the telephone number, whereby the alias IP address is derived from a telephone number (including area and country codes) as follows:

f) updating of the database by the host with the received information.

10. Method of establishing communication according to claim 1 to a central host by devices at remote locations, all with access to the Public Switched Telephone Network (PSTN), in order to transfer information from meters to the central host, comprising the steps of:

a) setting up a telephone connection to the central host by the device at the remote location;

b) acceptance of the call by the host device;

c) establishing the data link, and PPP connection between the sender and receiver application;

d) transfer the information to the host device over TCP/IP;

e) termination of the data link and telephone call;

f) updating of the database by the host with the received information;

11. Stand-alone apparatus to be installed at the remote location which is able to perform all the applicable steps presented in claims 9 and 10, both as receiver and sender.

12. Host apparatus to be installed at the central site which is able to perform all the applicable steps presented in claims 9 and 10, both as receiver and sender.

13. Method of using an arbitrary 32-bit identifier as alias IP address for the purpose of TCP/IP communication.

14. Method according to claim 1 of providing home automation network functionality as a TeleMail-based application, comprising the steps of:

a) connecting a System Control Unit to the TeleMail device, and to the in-house mains network;

b) inserting Appliance Control Units between the controlled appliances, and to the in-house mains network;

h) independent background execution of the scheduled actions by the Scheduler function, as described in steps f) through h) of claim 1.

16. Stand-alone or TeleMail-integrated System Control Unit to be connected to the TeleMail device, and to the mains network, which is able to perform all the applicable steps presented in claims 14 and 15.

17. Stand-alone or appliance-integrated Appliance Control Unit to be connected to the addressed appliance, and to the mains network, which is able to perform all the applicable steps presented in claims 14 and 15.

18. Method of combining a unique System Control Unit identifier, and an assignable Appliance Control Unit identifier to uniquely qualify a home automation network, and the member Appliance Control.Units connected to it.

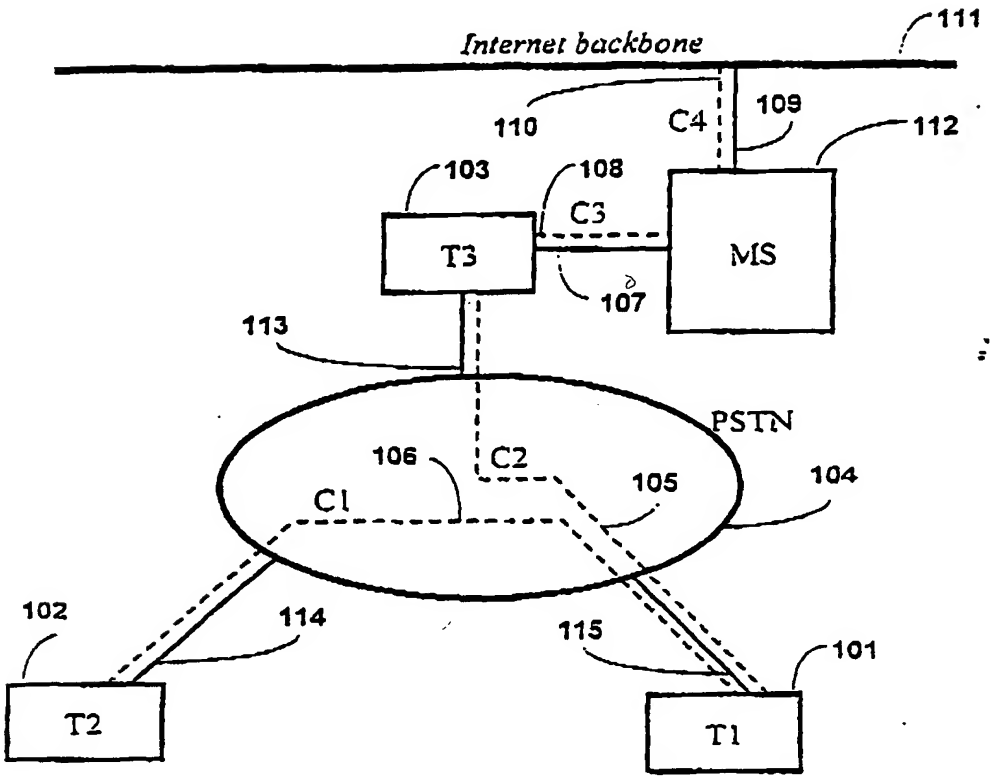

Internet backbone
111
110
C4
109
112
103
108
C3
T3
MS
107
113
PSTN
106
C2
105
104
C1
102
114
115
101
T2
T1

Figure A1

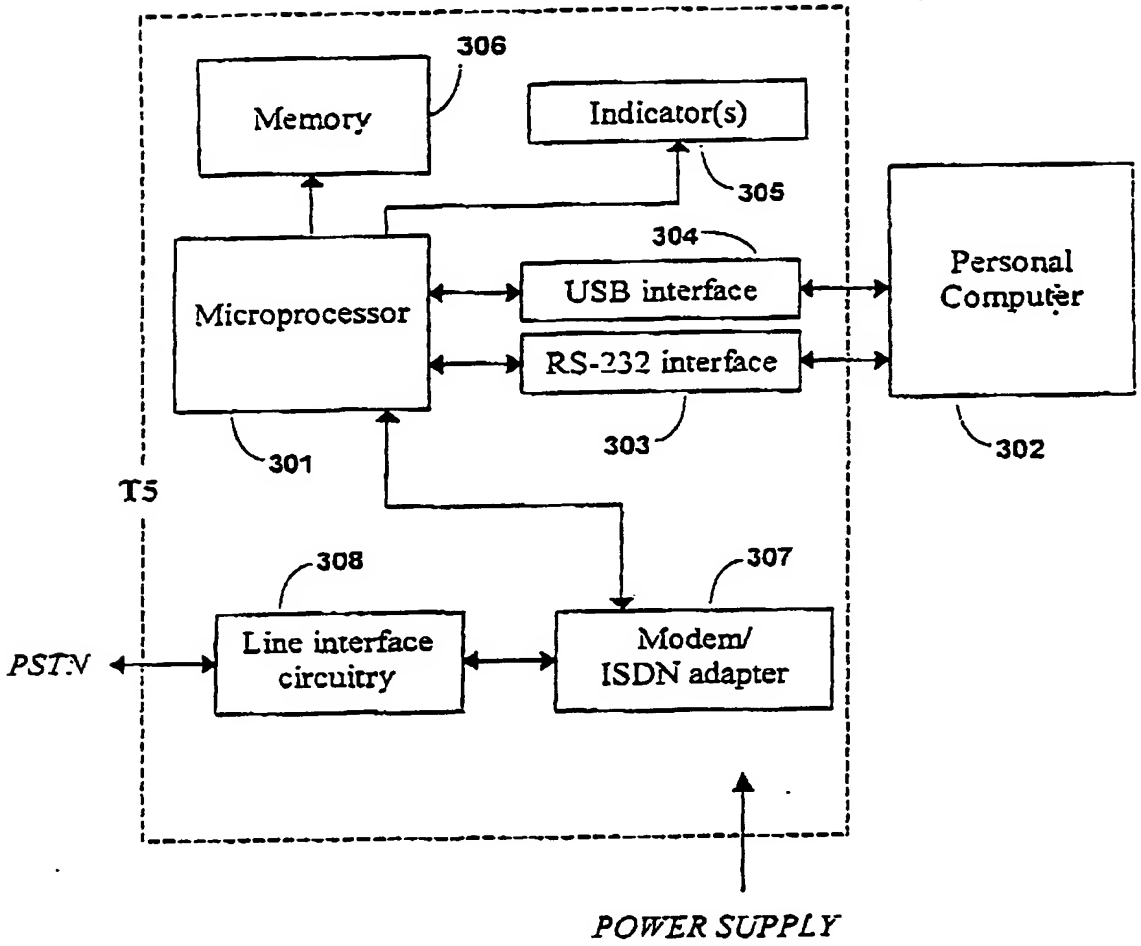


Figure A3

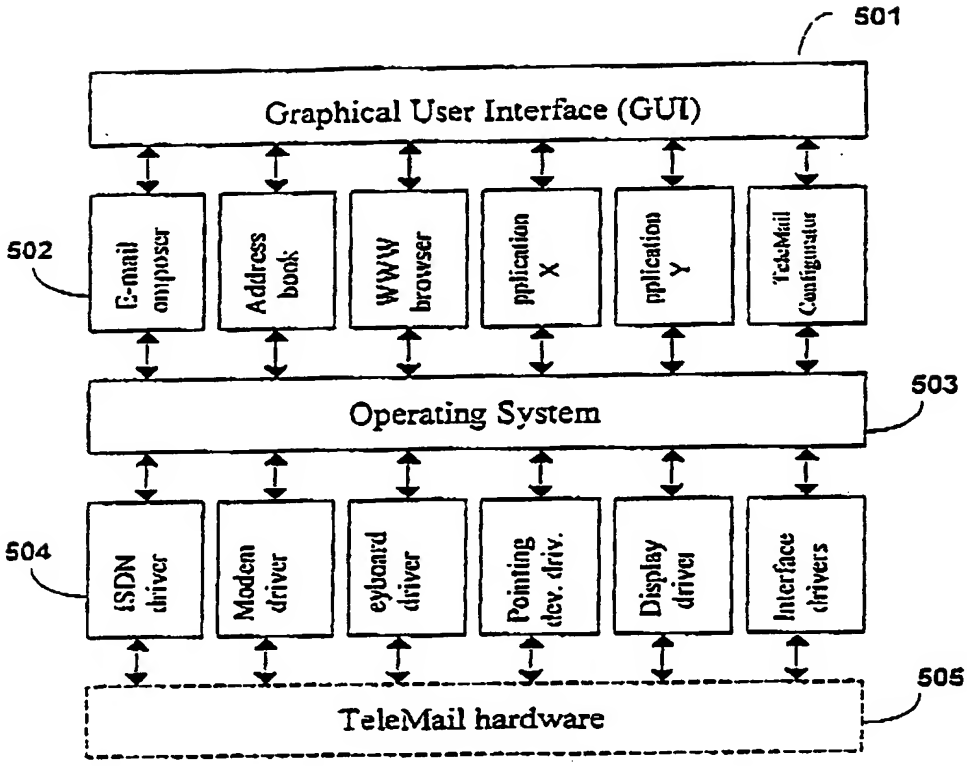
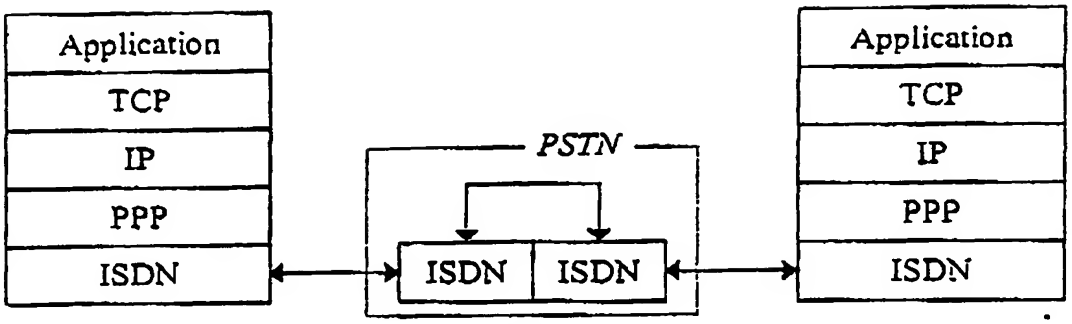

501
Graphical User Interface (GUI)
502
E-mail composer
Address book
WWW browser
Application X
Application Y
TeleMail Configurator
503
Operating System
504
ISDN driver
Modem driver
Keyboard driver
Pointing dev. driv.
Display driver
Interface drivers
505
TeleMail hardware

Figure A5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PPP
ISDN
PSTN
ISDN
ISDN
Application
TCP
IP
PPP
ISDN

Figure A7

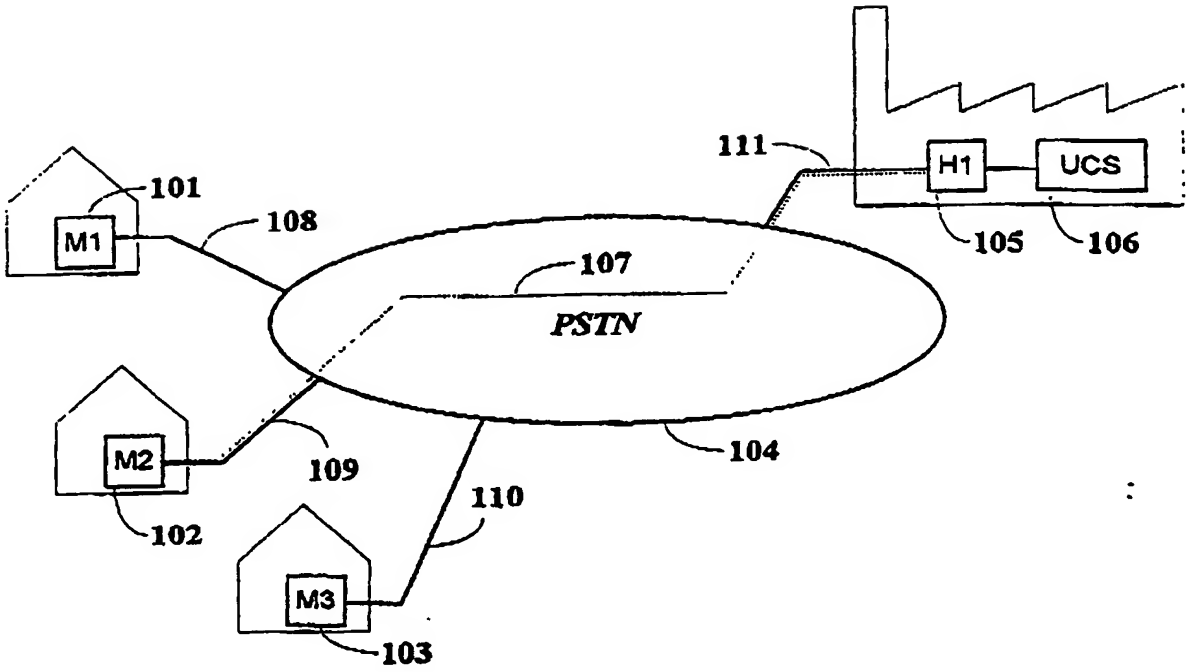

Figure B.1

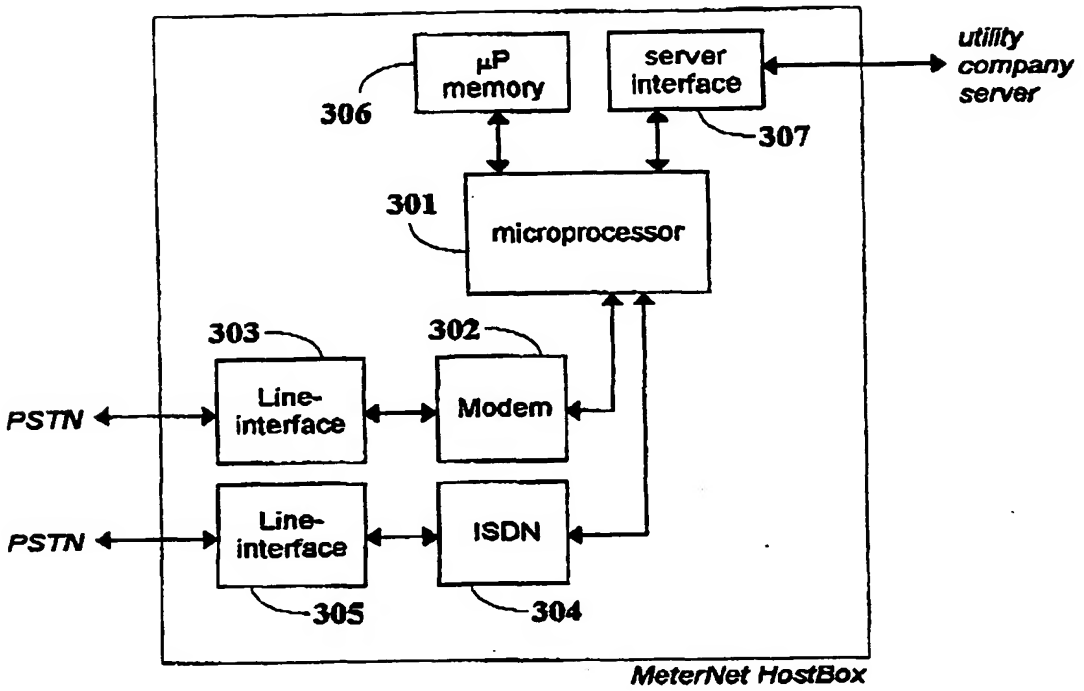
μP memory
306
server interface
307
utility company server
301
microprocessor
303
302
Line-interface
Modem
PSTN
Line-interface
ISDN
PSTN
305
304
MeterNet HostBox

Figure B.3

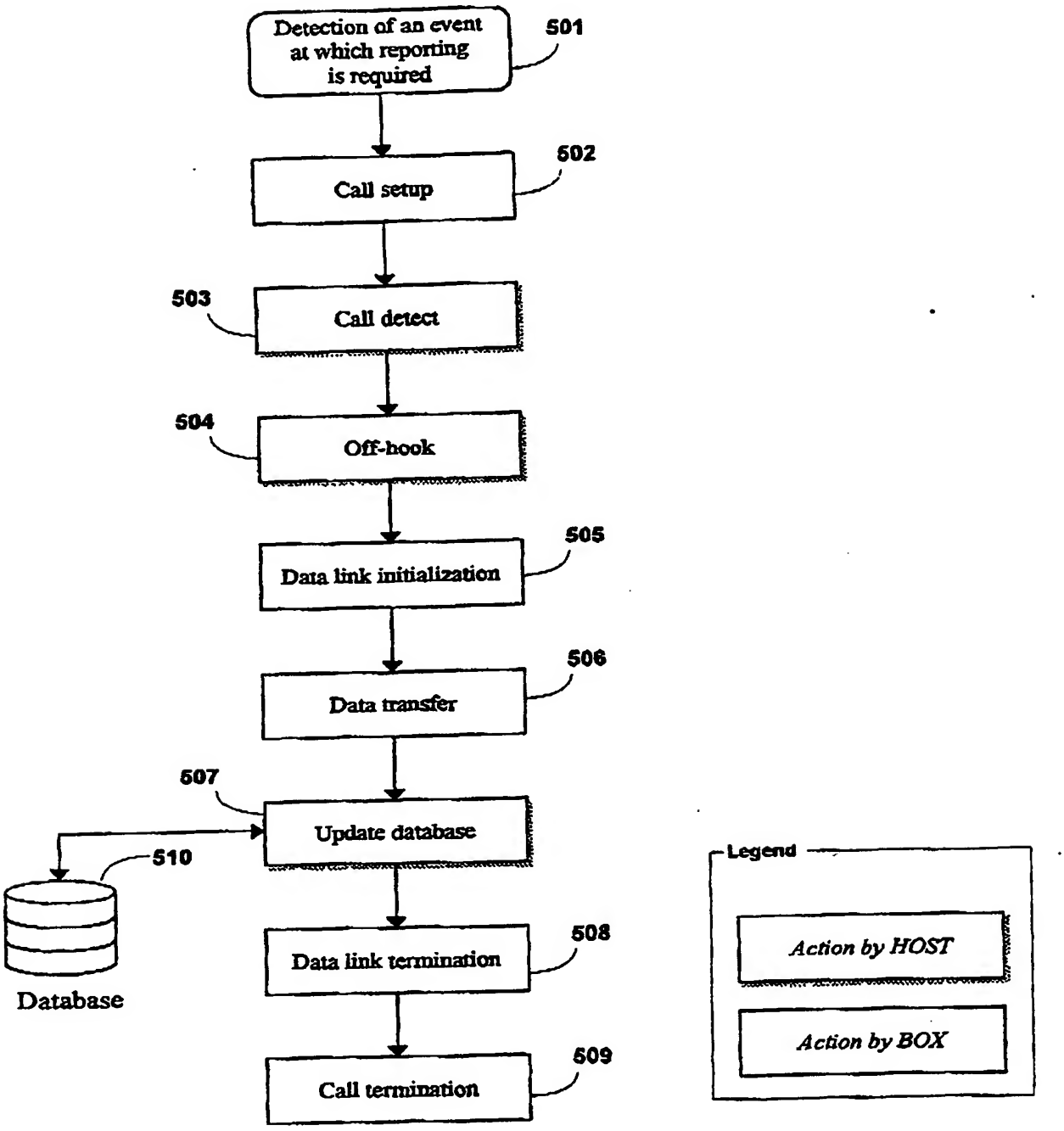

Figure B.5

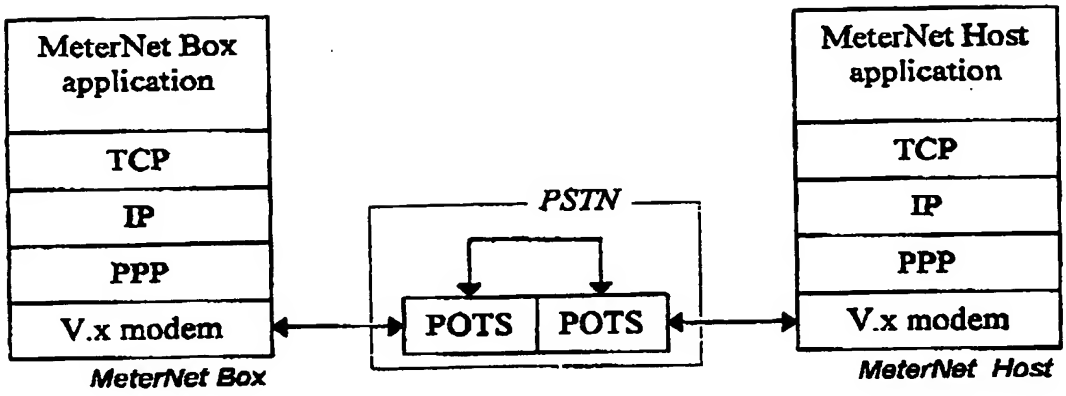

Figure B.7

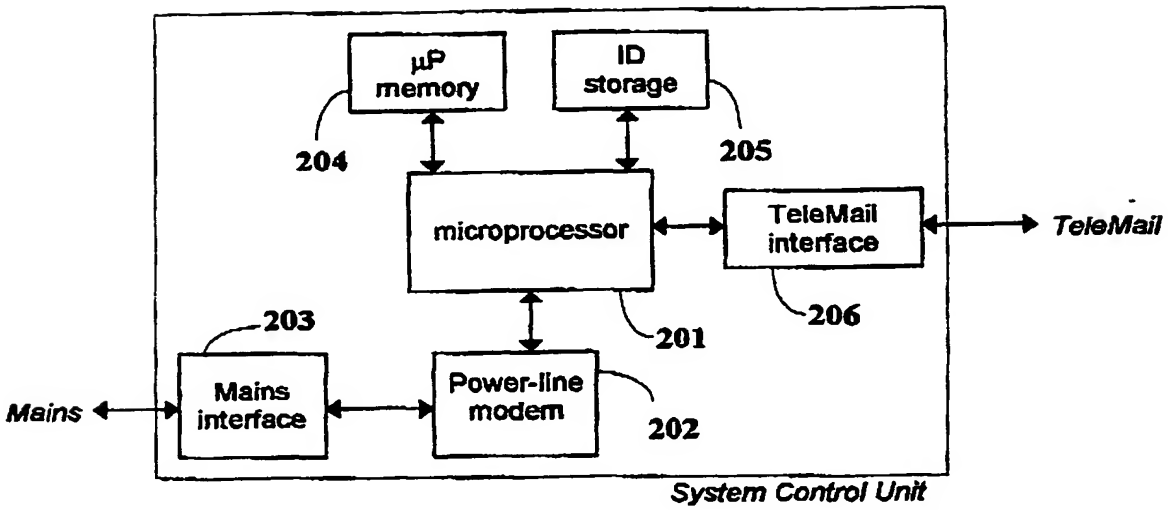
µP memory
ID storage
204
205
microprocessor
TeleMail interface
TeleMail
206
201
203
Mains
Mains interface
Power-line modem
202
System Control Unit

Figure C.2

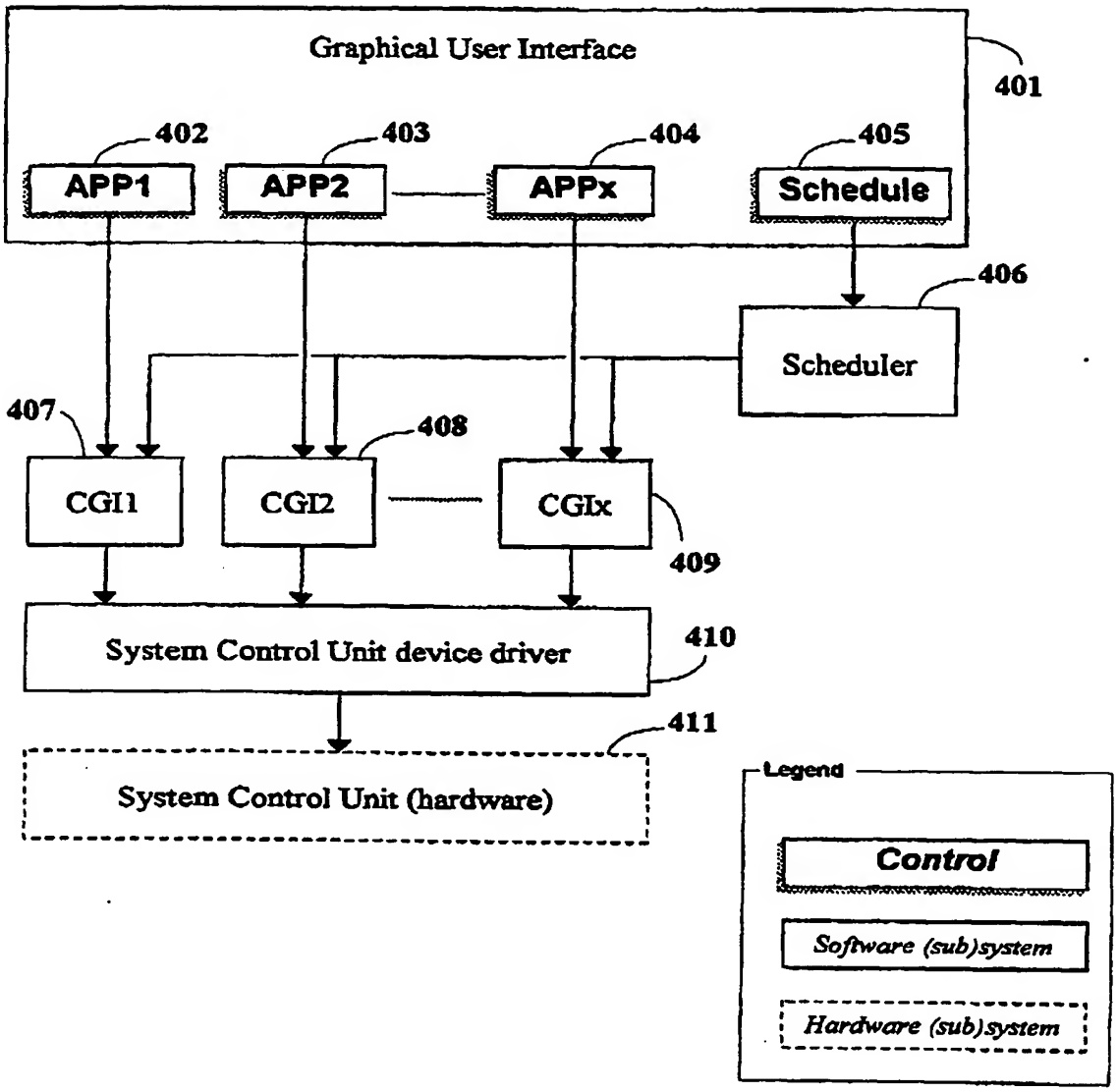
Graphical User Interface
401
402
403
404
405
APP1
APP2
APPx
Schedule
406
Scheduler
407
408
CGI1
CGI2
CGIx
409
System Control Unit device driver
410
411
System Control Unit (hardware)
Legend
Control
Software (sub)system
Hardware (sub)system

Figure C.4